

EXPLORING METABOLIC AND STOICHIOMETRIC CONTROLS FOR NUTRIENT EXCRETION: BODY SIZE HAS PRIMACY IN A TROPICAL STREAM FISH COMMUNITY

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March 27, 2022

Abstract

Discussions of the factors regulating nutrient recycling by consumers have focused on predictions from Ecological Stoichiometry (ES) and the Metabolic Theory of Ecology (MTE). ES posits that imbalances between the composition of an animal's body tissues and its diet should determine its nutrient excretion rates, whereas the MTE predicts that excretion should directly reflect metabolic activity arising from body size and temperature. Each framework has been supported by data, but they are rarely tested together. In this study, we measured excretion rates of nitrogen (NH₄), phosphorus (SRP) and N:P excretion ratio, body N:P stoichiometry, body size, and temperature for 12 species of fish from an Atlantic rainforest stream in Brazil. We fitted 8 competing models reflecting different combinations of ES (body N:P, armor classification, diet group) and MTE (body size, temperature) variables. For both N and P excretion, as well as excreted N:P ratio, only body size was included in the best model, and interspecific differences in size-scaling were greater for N than for P. Fitted size scaling coefficients were lower than the MTE prediction of 0.75 for both N (0.59, 95% CI = 0.45, 0.73) and P (0.56, 95% CI = 0.40, 0.77). There was only weak evidence that body armor in 3 of 12 species led to more retention of P, and there was no discernable effect of diet group, body N:P, or water temperature. We conclude that differences in nutrient excretion among species within a shared environment primarily reflect contrasts in metabolic rates arising from body size, rather than disparities between consumer and resource stoichiometry. Our findings align with those from other ecosystems and synthesis across aquatic taxa, expanding support for the MTE as the primary framework for predicting nutrient excretion rates. Key words: ecological stoichiometry, metabolic ecology, animals, nitrogen, phosphorus, freshwater.

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